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Cardiff Road
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1. Your reference

B112

2. Patent application number
(The Patent Office will fill in this part)

0329164.8

17 DEC 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Britax Romer Kindersicherheit GmbH
Postfach 3449
89024 ULM
Germany

Patents ADP number *(if you know it)*

5827514002

If the applicant is a corporate body, give the country/state of its incorporation

Germany

Britax Excelsior Limited
Seton House
Warwick Technology Park
Gallows Hill
Warwick CV34 6DE

Patents ADP number *(if you know it)*

6304307002

If the applicant is a corporate body, give the country/state of its incorporation

GB

4. Title of the invention

Belt Tension Indicator

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

A. Hollinghurst
Britax Childcare Limited
1 Churchill Way West
Andover
Hampshire
SP10 3UW

Patents ADP number *(if you know it)*

8449399001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
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Continuation sheets of this form	0
Description	9
Claim *(s)*	3
Abstract	0
Drawing *(s)*	6

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	4
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature A Hollinghurst, Agent for the Applicants Date 16 December 2003

12. Name and daytime telephone number of person to contact in the United Kingdom: A Hollinghurst (01264 386006)

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BELT TENSION INDICATOR

This invention relates to a belt tension indicator for use with a child safety seat.

Patent Application publication numbers WO02/26532 and US2003/0155166 disclose tension sensing systems for detecting the tension in a vehicle seat belt in order to control operation of an airbag. Such systems require connection to the electrical system of the vehicle in which they are installed and consequently are not suitable for fitting to child safety seats and other child restraints that are intended to be readily removable from a vehicle seat by a user.

According to the invention, a belt tension indicator comprises a static member, a moveable member adapted to be engaged by a seat belt, a spring connected to resist relative movement between the static member and the moveable member, and an signal device arranged to provide an indication of the position of the moveable member relative to the static member.

The signal device may be arranged to provide a visual indication of the position of the moveable member. The signal device may comprise an indexing device such as a pointer moving over a complementary device such as a scale. Alternatively, it may comprise a window arranged to selectively exposed different coloured zones of a background member.

In one form of the invention, the moveable member comprises a shaft journaled on the static member, the spring comprises a torsion spring and the visual signal device comprises an element coupled to the shaft for angular movement therewith.

In another form of the invention, the moveable member is mounted on the static member for linear movement relative thereto. The moveable member may be connected to a flexible strap. The static member may be connected either to a rigid anchorage or to another

flexible strap.

The static and movable members may take the form of two plates abutting one another and each having an aperture therein. The two apertures are substantially, but not completely, aligned with one another and the spring is arranged to urge an edge of one aperture to a position traversing the other aperture. A strap is passed through both apertures so as to wrap round said edge. Tension in the strap tends to pull said one edge into a alignment with a corresponding edge of the aperture. A pointer carried by or formed integrally with one of the plates, travels over a scale marking on the other plate.

Alternatively, the static member may comprise a housing, the spring being accommodated within the housing and having one end in static engagement therewith. The other end of the spring is engaged by the moveable member which may carry a pointer visible through an opening or window in the housing. Alternatively, the movement of the moveable member may be arranged to actuate at least one electrical switch.

Another form of signal device may be arranged to provide an audible signal when a required position is reached. The audible signal may be produced mechanically, in the form of a click or a bell-like ping. Alternatively, it may be produced electrically, with power derived from an internal battery

The invention is applicable to a child safety seat adapted to be secured on a vehicle seat using a vehicle seat belt, having a belt tension indicator of the type described above, with its static member mounted on the child seat in a position such that its moveable member abuts against the vehicle seat belt between two belt guides on the child seat, whereby increasing tension in the vehicle seat belt causes movement of the moveable member relative to the static member.

The invention is also applicable to a child safety seat having a child harness including shoulder straps, an adjuster for tightening said shoulder straps and a

belt tension indicator of the type described above, interconnecting the shoulder straps and the adjuster.

Embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a side view of a child safety seat having an upper tether strap incorporating a tension detector in accordance with the invention;

Figure 2 is a perspective view of the tension detector shown in Figure 1;

Figure 3 is a transverse cross sectional view of the tension detector shown in Figure 2;

Figures 4, 5 and 6 are sectional views on the lines 4-4, 5-5 and 6-6 respectively in Figure 3;

Figure 7 is a partially broken away perspective view of an alternative tension detector for use with the seat shown in Figure 1, without any load;

Figure 8 is a partially broken away perspective view, similar to Figure 7, but showing the tension detector on load;

Figure 9 is a perspective view similar to Figures 7 and 8 after a crash;

Figure 10 is a partially broken away perspective view of a modified tension detector similar to the tension detector of Figures 7 to 9;

Figure 11 is a perspective view of yet another tension detector in accordance with the invention;

Figure 12 is a plan view of the tension detector shown in Figure 11;

Figure 13 is a plan view of a modified version of the tension detector shown in Figures 11 and 12;

Figure 14 is a plan view of yet another modification of the tension detector shown in Figures 11 and 12;

Figure 15 is a side view of a tension detector in accordance with another embodiment of the invention, in a relaxed state;

Figure 16 is a plan view of the tension detector shown in Figure 15;

Figure 17 is a side view of the tension detector shown in Figures 15 and 16 but in the loaded state;

Figure 18 is a plan view of the tension detector shown in Figure 17;

Figure 19 is a side view of another tension detector in accordance with the invention;

Figure 20 is a plan view of the tension detector shown in Figure 19 in the unloaded state;

Figure 21 is a plan view of the tension detector shown in Figure 19 in the loaded state;

Figure 22 is side view of a child seat incorporating a tension detector in accordance with yet another embodiment of the invention; and

Figure 23 is an enlarged rear view of the lower part of the child seat shown in Figure 22.

Figure 1 shows a child safety seat 10 mounted on a vehicle seat 12 and secured in place by the lap strap 14 of a vehicle seat belt associated with the seat 12. In addition, a top tether strap 16 extends from an upper part of the child seat 10 to an anchorage 18 on a parcel shelf 20 located behind the backrest 22 of the vehicle seat 12. The tether strap 16 is connected to the anchorage 18 by a tension detector 24 in accordance with the invention.

Figures 2 to 6 show the tension detector 24 in more detail. An end of the tether strap 16 is wound on a spool 19 that is journaled on a rod 20 that has one end 22 secured fast in one end wall of a housing 24. The other end 26 of the rod 20 is journaled in an opposite end wall of the housing 24. The rod 20 serves as a cushion spring to provide shock absorption in the event of crash. A coil spring 28 is coupled between the second end 26 of the rod 20 and the spool 19. A snap hook 30 is connected by a pin 32 to the housing 24 and engages with the anchorage 18 on the parcel shelf 20 (Figure 1).

A cap 36 is secured to the end of the spool 19 nearer to the fixed end 22 of the torsion bar 20. A portion of the cap 36 is visible through a window 38 in

the adjacent end wall of the housing 24. The cap 36 has an axially aligned boss 40 that projects through a central hole in the end wall of the housing 24 and carries a stop 42 that engages with a complimentary formation on the end wall to limit retraction of the strap 16 on to the spool 19.

When the child seat 10 is installed on the vehicle seat 12, the hook 30 is engaged with the anchorage 18 and then the strap 16 is tightened by means of a strap adjuster (not shown) against the action of the coil spring 28, until a coloured sector on the end cap 36 is visible through the window 38, thus indicating that the strap 16 has been tightened sufficiently. In the event of a crash, the remaining webbing is drawn off the spool 19 and the shock at the end of this withdrawal is absorbed by the torsion bar 20.

Figure 7 illustrates an alternative tension detector in which the hook 30 is replaced by a second flexible strap 50 having its end stitched into a loop 52 that wraps round a central shaft 54. A one-piece coil spring having two coiled end portions 56 and 58 wrapped round the shaft 54. The end portions 56 and 58 are inter-connected by a central stirrup 60. The tether strap 16 has a loop 62 sewn into its end which engages round the stirrup 60. The ends of the shaft 54 are journaled in side walls of a housing 66. Each side wall has an inwardly direct abutment projection 68, one of which is visible in Figures 8 and 9.

The upper surface of the housing 66 includes a window 70 through which an arcuate indicator 72 is visible. The indicator 72 has side legs 74 and 76 that are slidably mounted on the stirrup 60.

When the strap 16 is relaxed, the left hand end of the arcuate indicator 72 is visible through the window 70, as shown in Figure 7. When the strap 16 is tightened, the arcuate indicator 72 pivots to the position shown in Figure 8 in which its right hand end, which is of a different colour to its left hand end, is visible through the window 70, indicating that the

strap 16 has been tightened adequately.

In the event of a crash, the coiled end portions 56 and 58 of the spring partially unwrap from the shaft 54 so that an extended stirrup portion 60 projects from the housing 66 as shown in Figure 9.

Figure 10 shows another form of tension detector which is identical to the tension detector shown in Figures 7 to 9, except that the second strap 50 is replaced by a hook 78, similar to the hook 30 of Figures 1 to 6.

Figures 11 and 12 show a hook 80, similar to the hook 30 of Figures 1 to 6. The hook 80 has a body portion 81 on which a moveable plate 82 is slidably mounted and biased towards the hook 80 by a tension spring 83. A strap 84 extends through respective windows 85 in the body portion 81 and the plate 82. When the spring 83 is in its relaxed state the strap 84 engages with the edge of the window 85 on the moving plate 82 and is held clear of the corresponding edge of the window 85 in the base portion 81. Index marks on the base portion 81 are visible through a hole 86 in the moving plate 82. When the strap 84 has been tightened sufficiently, an corresponding index mark is aligned with this hole 86.

Figure 13 shows a modified version of the hook shown in Figures 11 and 12 in that the spring 83 is replaced by leaf spring formations 89 that are formed integrally with the moving plate 82 and engage with the edge of the opening 85 in the base portion 81. In addition, the hole 86 is replaced by a pointer 87 that traverses over an index field 88 on the base portion 81.

Figure 14 illustrates another modification in which the hole 86 of Figures 11 and 12 is replaced by two holes 90 and 91 in a much smaller moving plate 92. The spring 83 is replaced by a single leaf spring 93 that operates in a similar manner to the leaf spring elements of 89 of Figure 13.

Figures 15 and 16 disclose an alternative form of

tension detector which can be used in place of the tension detector 24 of Figure 1. This tension detector has a housing 100 with a projecting end 102 containing an opening 104 through which a strap of a seat belt can project. A slider 106 projects through the other end of the housing 100 and has a hook formation 108 on its free end. The hook formation 108 can engage with an anchorage, such as the anchorage 18 of Figure 1, or an end of a tether strap.

Within the housing 100, the slider 106 has an abutment projection 109 that engages with a compression spring 110. The other end of the compression spring 110 abuts against the interior of the end wall of the housing through which the slider 106 projects. The abutment projection 109 has an index pointer 112 that projects outwardly through a slot 114 in the housing 100. When a strap connected to the opening 104 is tightened, the spring 110 is compressed until the index projection 112 indicates when the strap has been tightened sufficiently, as illustrated in Figures 17 and 18.

Figures 19 to 21 illustrate a modification of the tension detector shown in Figures 15 to 18, corresponding parts being denoted with the same reference numerals. However, the housing is replaced by a housing 120 having two indicator lights 122 and 124 mounted on its top surface, and the fixed projecting end 102 is replaced by a second slider 126 that is biased inwardly by a much lighter spring (not shown) that the spring 110. The indicator lights are powered from a battery within the housing 120 and are connected via switches responsive to the position of the slider 106. When the both springs are relaxed, both lights are off. When the second slider 126 is move outwardly, for example during installation in a vehicle, the light 122, which is preferably a red light, is illuminated. When the slider 106 has been displaced to an extent corresponding to the required belt tension, the light 122 is extinguished and the

light 124, which is preferably a green light, is illuminated. The light 124 is connected via a delay circuit arranged to extinguish it after a short time period, in order to avoid unnecessary battery drain.

Figures 22 and 23 illustrate a further embodiment of the invention applied to a child seat 130, that is adapted to be secured on a vehicle seat by at least the lap strap 132 of a vehicle seat belt, which extends over belt guides 134 and 136 on the sides of a base 138 of the seat 130. The lap strap 132 is pushed out of the direct path between the two guides 134 and 136 by a spring-loaded plunger 140 that projects from a housing 142. Within the housing 142, the plunger 140 co-operates with switches, similar to the switches of the tension detector shown in Figures 19 to 21, to control the operation of two indicator lights 144 and 146 that are located on a side wall of the seat base 138. As previously, the light 144 (preferably red) is arranged to illuminate when a low tension is applied to the strap 132 and the light 146 (preferably green) to illuminate when adequate tension is applied. Once again, a delay circuit is provided in order to turn off the light 146 and thus prevent unnecessary battery drain. A second set if indicator lights, connected in parallel with the indicator lights 144 and 146, may be mounted on the other side of the child seat 130. A push button may be provided to energise the light 146 temporarily to permit a user to check that the lap strap is still adequately tensioned if the child seat 130 has been left in a vehicle from a previous journey.

In a further embodiment of the invention (not shown) a tension detector such as that illustrated in Figures 19 to 21 is connected between the shoulder straps of a harness fitted to a child seat of the type illustrated in Figures 1 and 22 and an adjuster for such shoulder straps. A single indicator light, responsive to detection of adequate tension, is mounted remotely, for example in the position of the indicator lamps 144 and 146 of Figure 22. When the harness is

tightened sufficiently, the indicator light illuminates. When the tightening force is removed, the locking mechanism engages, allowing a small amount of slack to be fed into the shoulder straps. This is insufficient to slacken the shoulder straps to an undesirable extent but sufficient to extinguish the indicator light or silence the alarm. Consequently no separate delay circuit for this purpose is necessary. If this embodiment is used in conjunction with the embodiment of Figures 22 and 23, tightening the shoulder straps may also be arranged to energise the light 146 temporarily to permit a user to check that the lap strap is still adequately tensioned.

Alternatively the indicator light of this further embodiment may be replaced by an electrically activated audible alarm that sounds when the harness is tightened sufficiently. Another alternative is to replace the electrically activated alarm by a mechanical device arranged to produce a sound such as a click or a bell-like ping when the harness is tightened sufficiently. This avoids the need for a battery.

CLAIMS

1. A belt tension indicator comprising a static member, a moveable member adapted to be engaged by a seat belt, spring connected to resist relative movement between the static member and the moveable member, and a signal device arranged to provide an indication of the position of the moveable member relative to the static member.

2. A belt tension indicator according to claim 1, wherein the signal device is arranged to provide a visual indication of the position of the moveable member.

3. A belt tension indicator according to claim 2, wherein the signal device comprises an indexing device moving over a complementary device.

4. A belt tension indicator according to claim 2, wherein the signal device comprises a window arranged to selectively exposed different coloured zones of a background member.

5. A belt tension indicator according to claim 1, wherein the moveable member comprises a shaft journaled on the static member, the spring comprises a torsion spring and the visual signal device comprises an element coupled to the shaft for angular movement therewith.

6. A belt tension indicator according to claim 1, 2 or 3, wherein the moveable member is mounted on the static member for linear movement relative thereto.

7. A belt tension indicator according to claim 6, wherein the moveable member is connected to a flexible strap.

8. A belt tension indicator according to claim 6 or 7, wherein the static member is connected to a rigid anchorage.

9. A belt tension indicator according to claim 6 or 7, wherein the static member is connected to a flexible strap.

10. A belt tension indicator according to claim 6, 7 or 8, wherein the static member comprises a first plate

and the movable member comprises a second plate abutting the first plate, each plate having an aperture therein and the spring being arranged to urge an edge of one aperture to a position traversing the other aperture

11. A belt tension indicator according to claim 6, 7 or 8, wherein the static member comprises a housing, the spring being accommodated within the housing and having one end in static engagement therewith, and the movable member engages with the other end of the spring.

12. A belt tension indicator according to claim 11, wherein, a pointer on the moveable member is visible through an opening in the housing.

13. A belt tension indicator according to claim 11, wherein movement of the moveable member is arranged to actuate an electrical switch.

14. A belt tension indicator according to claim 1, wherein the signal device is arranged to provide an audible signal.

15. A belt tension indicator according to claim 14, wherein the audible signal is produced mechanically.

16. A belt tension indicator according to claim 14, wherein the audible signal is produced electrically, with power derived from a battery within the tension indicator

17. A belt tension indicator according to claim 1, 2, 3 or 4, wherein a first tensioning stage is arranged to indicated correct belt tensioning and a second stage activates shock absorption in the event of an excess load.

18. A child safety seat adapted to be secured on a vehicle seat using a vehicle seat belt, having a belt tension indicator according to claim 1 or 2, with its static member mounted on the child seat in a position such that its moveable member abuts against the vehicle seat belt between two belt guides on the child seat, whereby increasing tension in the vehicle seat belt causes movement of the moveable member relative to the

static member.

19. A child safety seat having a child harness including shoulder straps, an adjuster for tightening said shoulder straps and a belt tension indicator according to claim 1 or 2, interconnecting the shoulder straps and the adjuster.

20. A belt tension indicator substantially as hereinbefore described with reference to the accompanying drawings.

Fig. 1

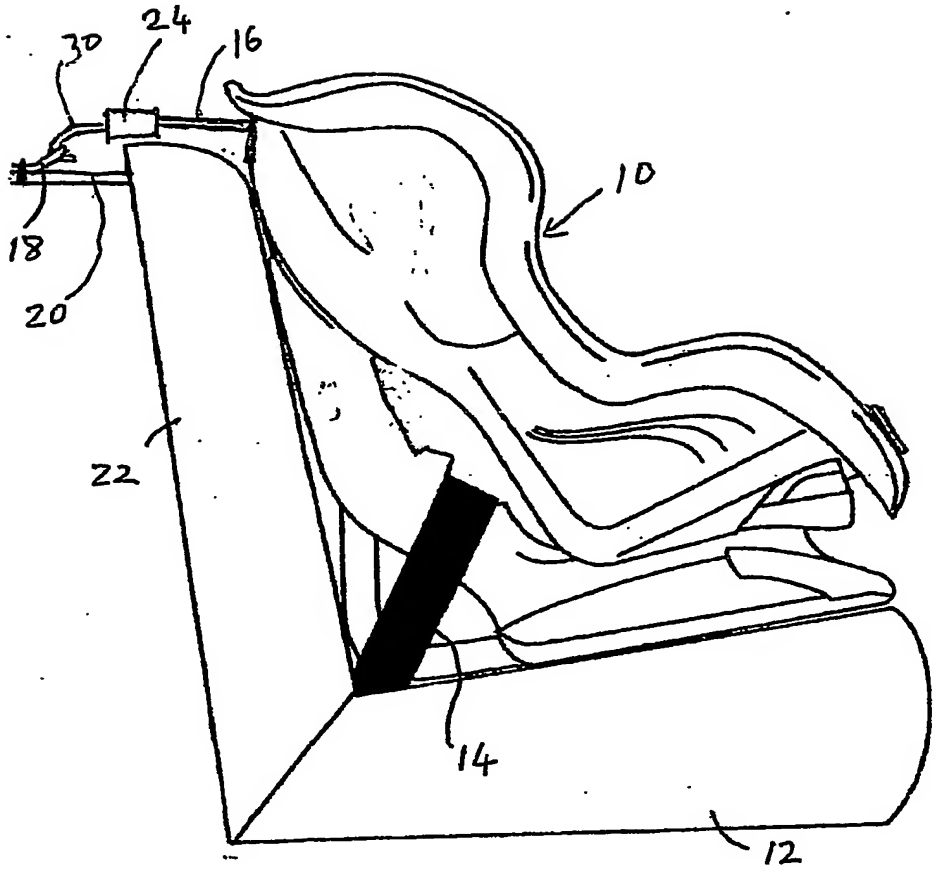


Fig. 2

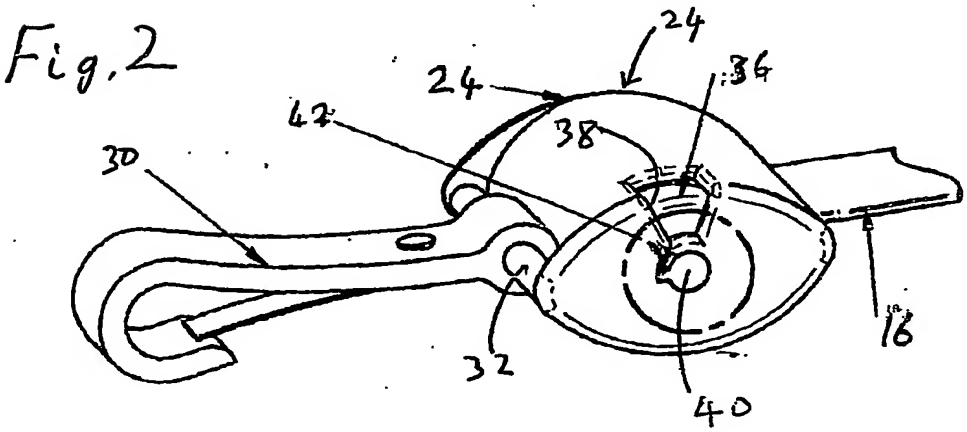


Fig.3

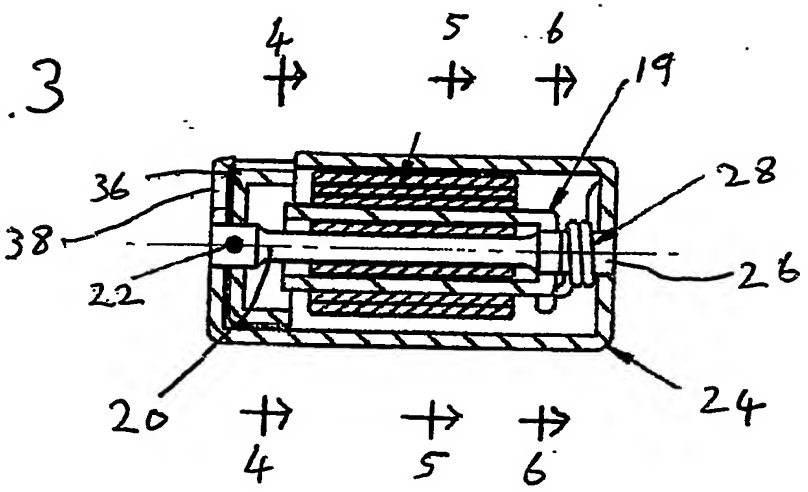


Fig 4

Fig.5

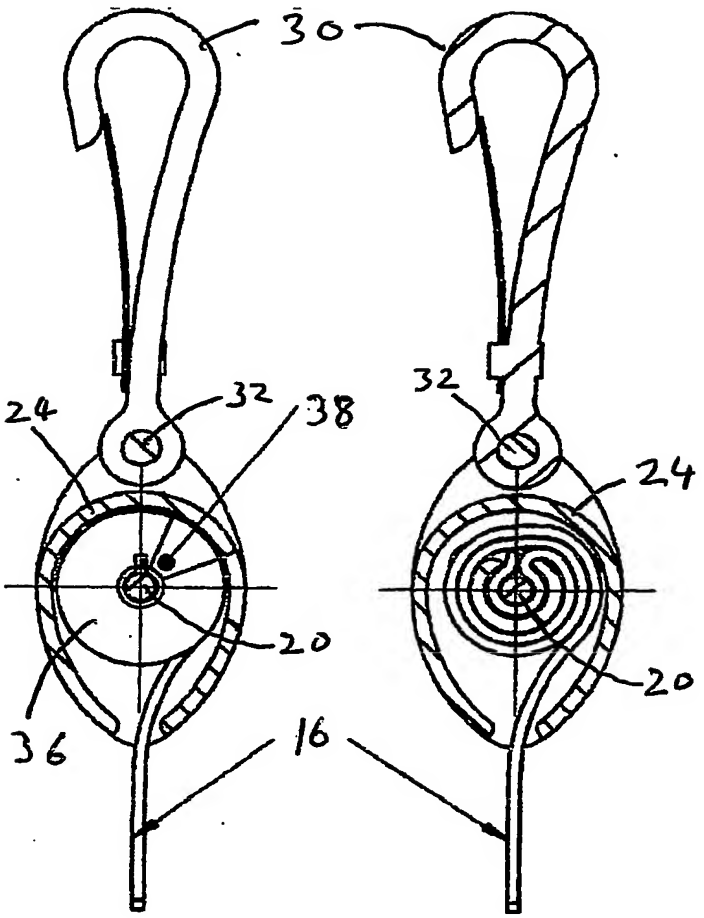


Fig.6

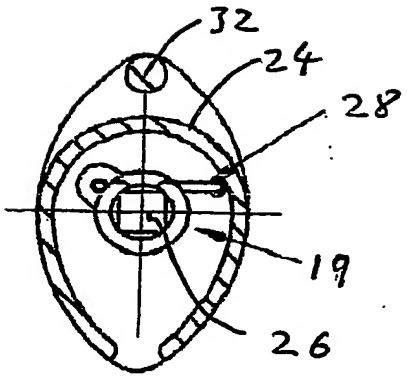


Fig 7

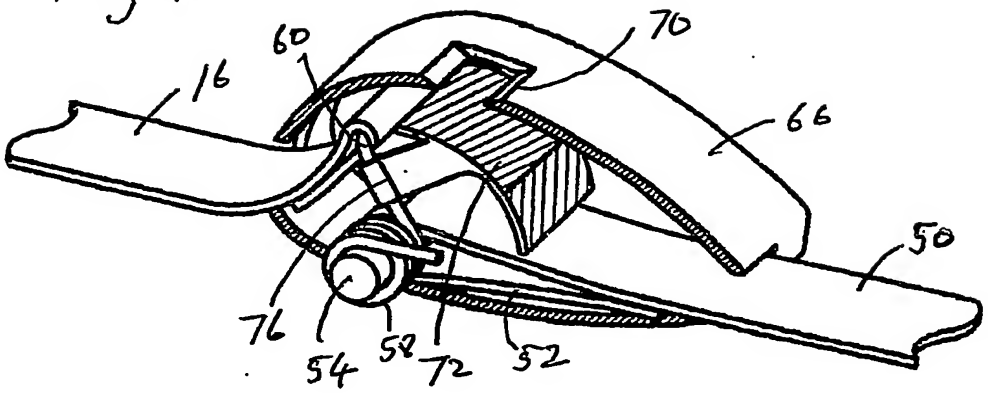


Fig. 8

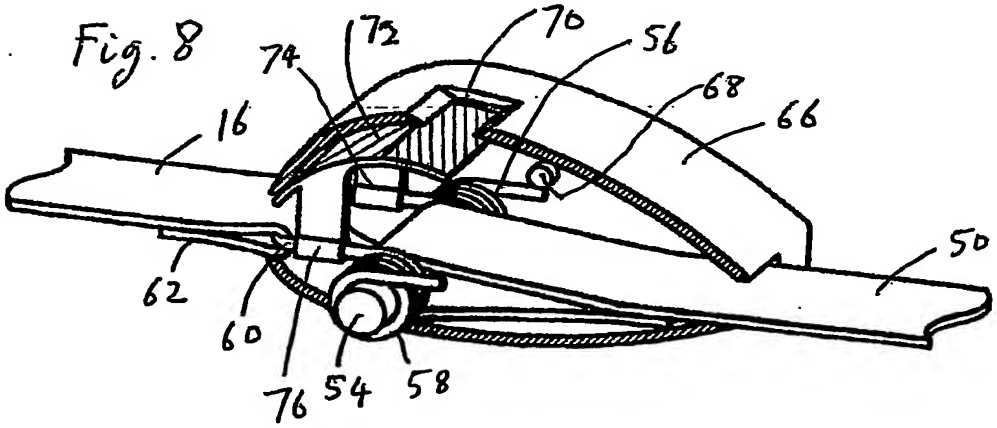


Fig. 9

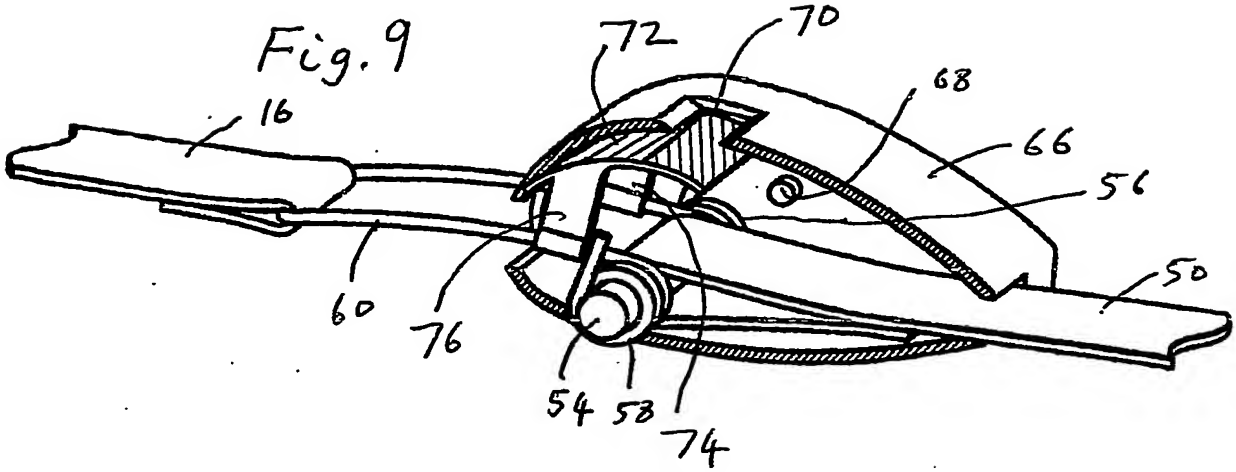
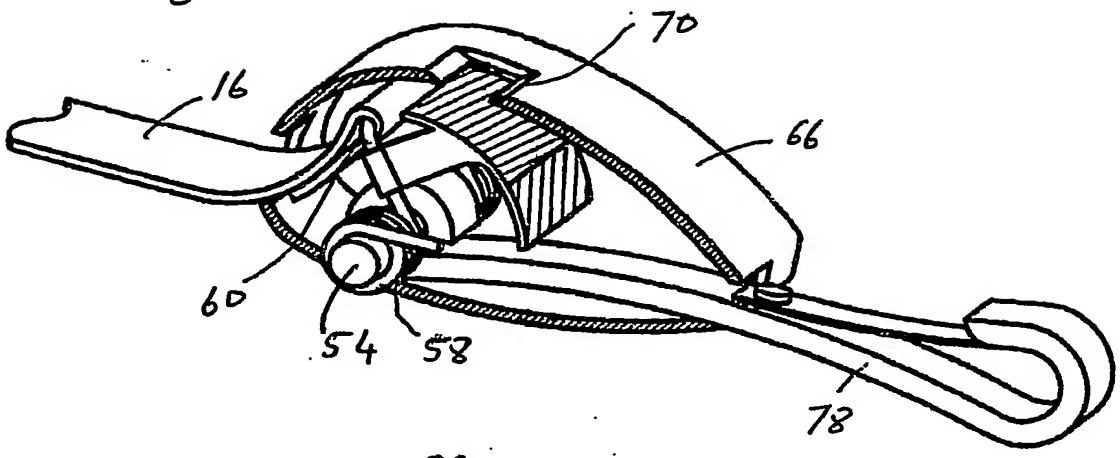


Fig 10



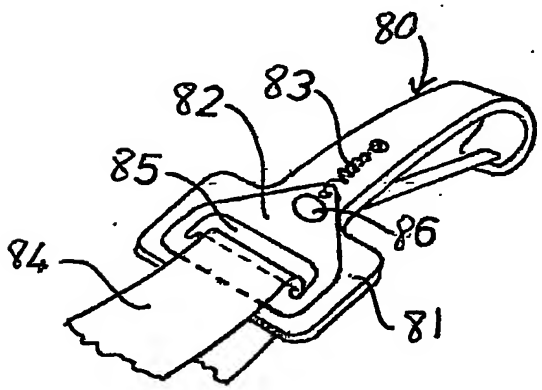


Fig.11

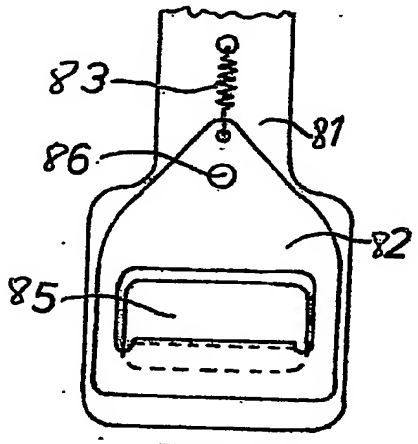


Fig.12

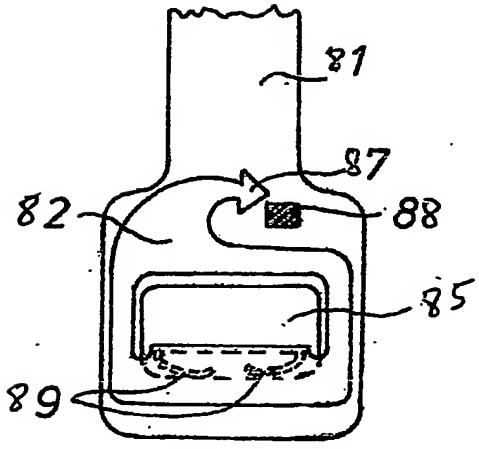


Fig.13

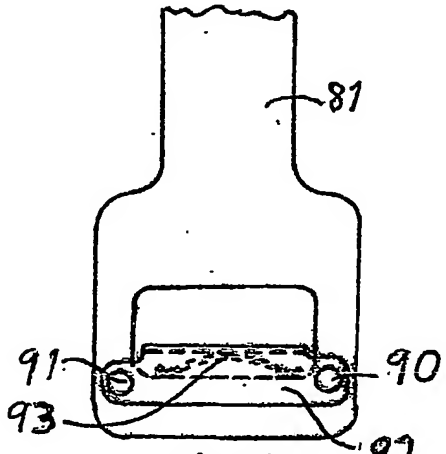


Fig.14

Fig 15

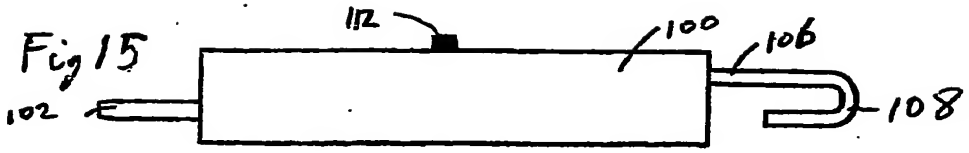


Fig 16

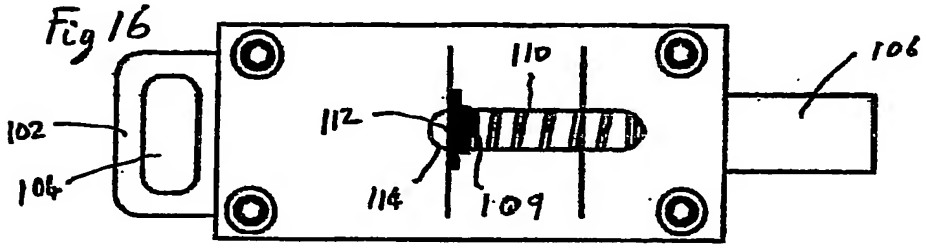


Fig 17

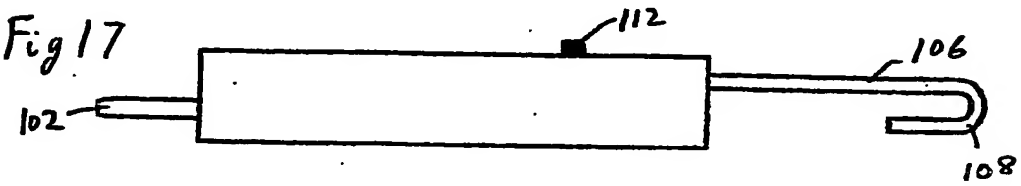


Fig 18

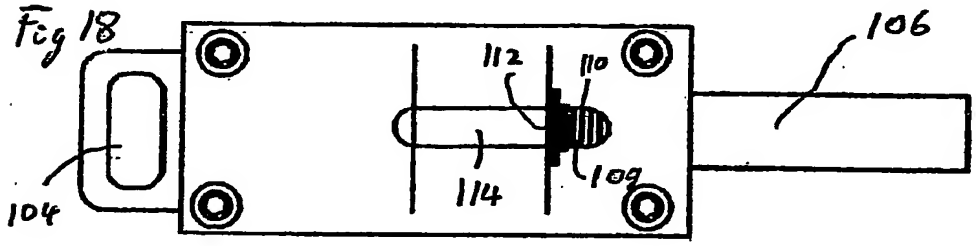


Fig 19

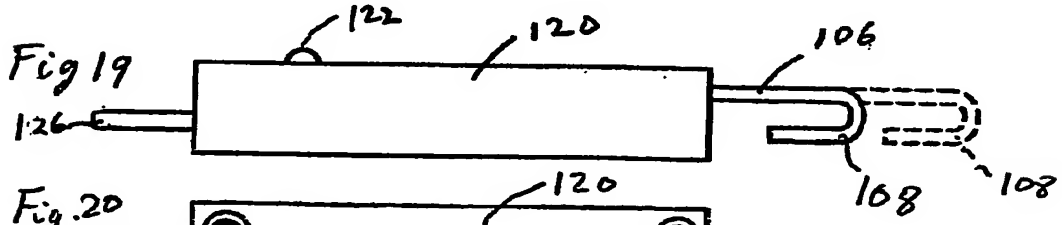


Fig 20

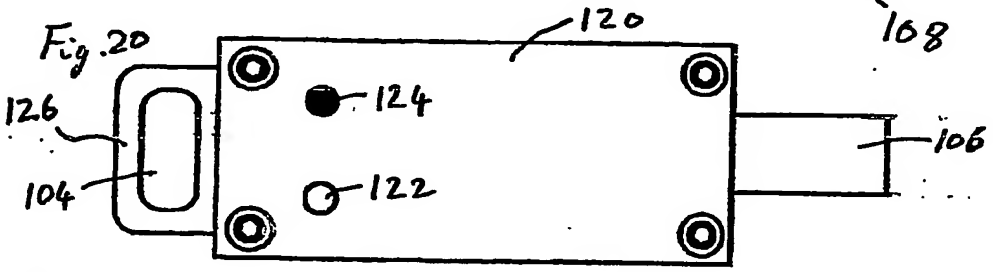


Fig 21

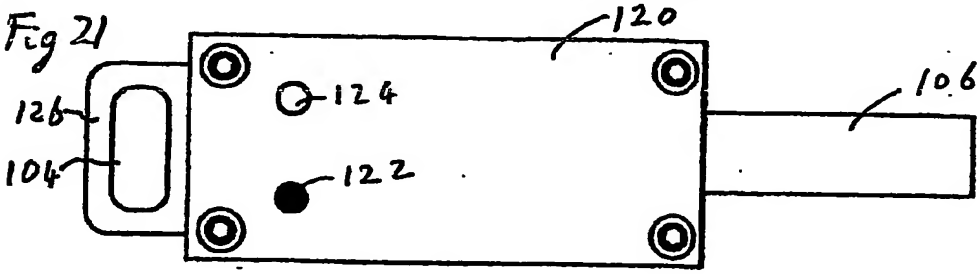


Fig. 22

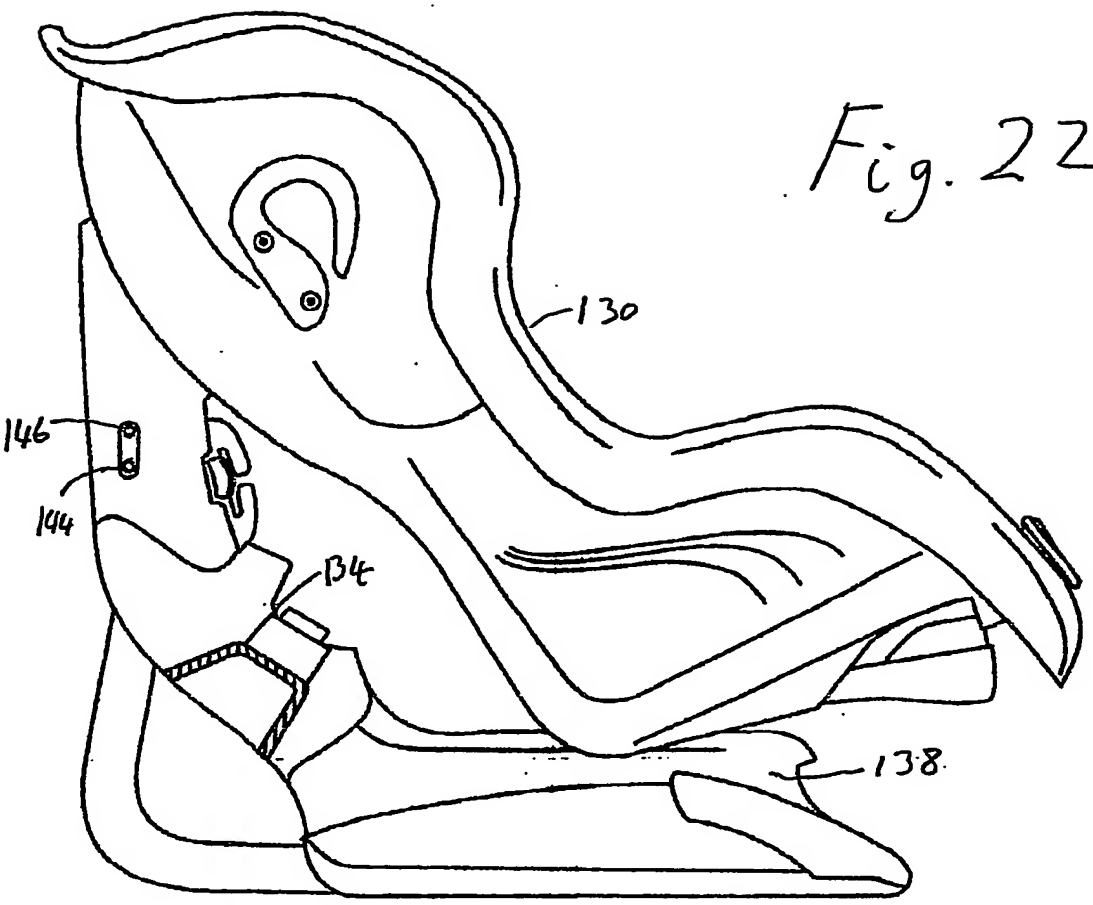


Fig. 23